Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Spectrum Horizons	)	ET Docket No. 18-21

REPLY COMMENTS OF THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION

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May 17, 2018

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The Telecommunications Industry Association ("TIA")[1] hereby submits these reply comments in response to the Commission's *Notice of Proposed Rulemaking* ("*Notice*")[2] in the above-captioned proceeding. TIA once again commends the Commission for its continuing efforts to make more spectrum available and to support innovation in the bands above 95 GHz.

I. INTRODUCTION AND SUMMARY

TIA's initial comments focused mainly on potential improvements to the Commission's proposals for experimental licensing rules in the bands above 95 GHz.[3] However, the record in this proceeding now clearly demonstrates that there is sufficient interest and technological development for the Commission to move forward with establishing regular service rules in bands above 95 GHz. Specifically, the rules should largely be based upon those for the 70/80/90 GHz bands, should allow for point-to-multipoint use and for some mobile operations, should

[1] TIA is the leading trade association for the information and communications technology ("ICT") industry, representing companies that manufacture or supply the products and services used in global communications across all technology platforms. TIA represents its members on the full range of policy issues affecting the ICT industry and forges consensus on industry standards.

[2] Notice of Proposed Rulemaking and Order, *Spectrum Horizons*, ET Docket No. 18-21, rel. Feb. 28, 2018, FCC 18-17 ("Notice").

[3] Comments of the Telecommunications Industry Association, filed May 2, 2018 in ET Docket No. 18-21 ("TIA Comments").

allow some fixed point-to-point use in bands above 275 GHz, may consider reserving some spectrum for satellite end-user terminals, should open 15.2 GHz of spectrum above 95 GHz for unlicensed operations, and must account for actions elsewhere to promote global harmonization.

Meanwhile, TIA and its members continue to review the proposed technical rules and suggestions for changes from various commenters, and we plan to work with the Commission going forward as the technology matures. For now, TIA agrees with commenters who urge eliminating or relaxing the antenna gain requirement. TIA also urges the Commission to allow equipment authorization via the Supplier's Declaration of Conformity procedure rather than via certification, and to provisionally extend RF exposure rules for these bands to allow equipment certification to begin sooner. Finally, TIA supports the use of the knowledge database ("KDB") process to implement measurement guidance, but encourages the Commission to build on its recent efforts to ensure that its Office of Engineering and Technology ("OET") is sufficiently staffed to provide such guidance.

II. THE COMMISSION SHOULD ESTABLISH REGULAR SERVICE RULES FOR BANDS ABOVE 95 GHZ.

In the Notice, the Commission explained that the technology for practical RF communications above 95 GHz is currently at a "very nascent stage."[4] However, the record demonstrates significant interest among and activity in the ICT industry for developing these bands. For example, Ericsson Research has already worked with researchers in Sweden to

[4] Notice ¶ 67.

develop a D-band (110-170 GHz) transceiver module.[5] Qualcomm believes that it is well positioned to develop capabilities for the new bands, and expects that RF operations above 95 GHz will build upon the technologies the company has developed for millimeter-wave bands previously allocated.[6] Nokia recently collaborated with NTT DoCoMo to demonstrate 90 GHz technologies at the Brooklyn 5G Summit,[7] and has filed applications with the Commission seeking to conduct tests between 90-96 GHz.[8] Meanwhile, wireless operators believe the spectrum is very suitable for potential 5G backhaul, among other applications.[9]

In contrast to commenters who assert that "there has been virtually no development of commercial wireless technology" in these bands – and that adopting any non-experimental service rules would therefore be "premature"[10] – the record above demonstrates that industry is actively pursuing development in bands above 95 GHz. Standardization work is also proceeding

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[5] Comments of Ericsson, filed May 2, 2018 in ET Docket No. 18-21, at 8-9 ("Ericsson Comments") (citing Jonas Edstam *et al.*, *Microwave Backhaul Evolution – Reaching Beyond 100 GHz*, ERICSSON TECHNOLOGY REVIEW, at 10 (Feb. 21, 2017) ("Ericsson Above 100 GHz Report"), https://www.ericsson.com/assets/local/publications/ericsson-technology-review/docs/2017/etr-beyond100ghz.pdf).

[6] Comments of Qualcomm Incorporated, filed May 2, 2018 in ET Docket No. 18-21, at 3-4 ("Qualcomm Comments").

[7] Comments of the mmWave Coalition, filed May 2, 2018 in ET Docket No. 18-21, at 3 ("mmWave Coalition Comments") (citing Monica Alleven, *Nokia, DoCoMo to Demonstrate 5G NR at 90 GHz During Brooklyn 5G Summit*, FIERCEWIRELESS, Apr. 24, 2018, https://www.fiercewireless.com/wireless/nokia-docomo-to-demo-5g-nr-at-90-ghz-during-brooklyn-5g-summit)

[8] Monica Alleven, *Nokia plans to conduct 90-96 GHz tests*, FIERCEWIRELESS, Oct. 13, 2017, https://www.fiercewireless.com/wireless/nokia-plans-to-conduct-90-96-ghz-tests

[9] *See, e.g.*, Comments of T-Mobile USA, Inc., filed May 2, 2018 in ET Docket No. 18-21, at 4 ("T-Mobile Comments") (describing reasons why the spectrum above 95 GHz is well-suited for 5G backhaul).

[10] Comments of Google LLC, filed May 2, 2018 in ET Docket No. 18-21, at 2 ("Google Comments"); *see also* Comments of Wi-Fi Alliance, filed May 2, 2018 in ET Docket No. 18-21 ("Wi-Fi Alliance Comments").

in these bands, with the IEEE 802 LAN/MAN Standards Committee adopting a new standard in October 2017 for wireless communication between 252-325 GHz,[11] and with even higher bands from 275-450 GHz on the agenda for WRC-19.[12] Meanwhile, even the National Academy of Sciences' Committee on Radio Frequencies has expressed openness to commercial use of the bands if appropriate protections are provided for incumbent radio astronomy service (RAS) and earth exploration-satellite service (EESS) operations.[13] Against this backdrop, the Commission can and should establish regular, non-experimental service rules for bands above 95 GHz.

III. SERVICE RULES AND BAND PLANS SHOULD ALLOW FOR DIFFERENT USE CASES WHILE ALSO CONSIDERING GLOBAL HARMONIZATION.

The record reveals several important principles that the Commission should consider when adopting service rules for bands above 95 GHz. These principles are bound together by a common thread of allowing different use cases and licensing models to flourish, while considering the important interest in global harmonization of band plans developed elsewhere. While TIA generally does not endorse specific allocation amounts or band plans in these reply comments, the Commission should nevertheless be guided by the principles below.

A. Service Rules Should Largely Be Based on the 70/90/90 GHz Rules and Link Registration Scheme for Fixed Point-to-Point Operations.

There is widespread support in the record for generally basing service rules for bands above 95 GHz on the rules now applicable to the 70/80/90 GHz bands. For example, TIA agrees

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[11] Letter from Paul Nikolich, IEEE 802 LAN/MAN Standards Committee Chairman, to Marlene H. Dortch, filed May 2, 2018 in ET Docket No. 18-21, at 1-2 ("IEEE 802 LAN/MAN Standards Committee Comments") at 1-2; *see also* Letter from Prof. Dr-Ing. Thomas Kürner to Federal Communications Commission, filed March 30, 2018 in ET Docket No. 18-21, at 1 ("Technische Universität Braunschweig Comments") at 1.

[12] IEEE 802 LAN/MAN Standards Committee Comments at 2.

[13] Comments of the National Academy of Sciences' Committee on Radio Frequencies, filed March 30, 2018 in ET Docket No. 18-21, at 16.

with Ericsson that the Commission should adopt its proposal for a non-exclusive nationwide licensing framework for point-to-point users and registration of individual point-to-point links with a third-party database manager.[14] Similarly, TIA agrees with Qualcomm that the Commission's proposal to codify that first-in-time use does not necessarily mean priority relative to current or future users "makes good sense" to avoid preventing a new innovative deployment in this "greenfield spectrum."[15] CTIA also agrees that the Commission's new rules should be "consistent with the flexible framework established for the 70/80/90 GHz bands,"[16] and TIA agrees with CTIA's conclusion that "extending the duties of the existing 70/80/90 GHz database managers to the spectrum above 95 GHz would be the best approach."[17]

B. The Commission Should Permit Some Point-to-Multipoint Use.

TIA agrees with several commenters that the Commission should accommodate point-to-multipoint systems as well as point-to-point systems. As the mmWave Coalition points out, allowing point-to-multipoint operations "would enable more diverse deployments such as on lamp posts and similar structures instead of being limited to towers, building rooftops, hills, etc."[18] Qualcomm proposes that the Commission should permit point-to-multipoint operations in part because the "pencil beam" style of transmitters and receivers above 95 GHz means that the incremental impact on a first system of introducing a second (or third) system on the same spectrum can be minimal, lessening the need for complex rules to govern spectrum sharing.[19]

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[14] Ericsson Comments at 13 (citing Notice ¶¶ 29-30).

[15] Qualcomm Comments at 10 (citing Notice ¶ 42).

[16] Comments of CTIA, filed May 2, 2018 in ET Docket No. 18-21, at 3 ("CTIA Comments").

[17] CTIA Comments at 8.

[18] mmWave Coalition Comments at 5.

[19] Qualcomm Comments at 8-9.

And Starry Inc. suggests that point-to-multipoint could be accommodated in a variety of ways, "including by allowing point-to-point including by allowing point-to-multipoint sites to coordinate into a band just like point-to-point, or by dividing the bands to allow point-to-multipoint in a subset of them."[20]

Meanwhile, Ericsson does not oppose deploying fixed point-to-multipoint systems "provided that each link within such systems is registered as a discrete link (as opposed to issuance of a block license)."[21] For these reasons, TIA agrees with CTIA that allowing point-to-point licensing would "increase flexibility for licensees."[22] TIA also agrees that "varying use cases (point-to-point, multipoint, mobile) should be governed by database managers and the industry rather than dictated by Commission rules."[23]

C. The Commission Should Open Some Bands for Mobile Use.

TIA agrees with Qualcomm that the Commission should open some bands above 95 GHz for licensed mobile use.[24] CTIA concurs that "opportunities for mobile wireless services in the bands above 95 GHz [should] not [be] foreclosed," since the wireless industry is "constantly innovating and utilizing different spectrum bands for delivery of service to consumers."[25] T-Mobile also concurs that the Commission should be "mindful of the potential to use the spectrum for mobile use in the future," and that at a minimum, "entities that use the spectrum for point-to-

[20] Comments of Starry, Inc., filed May 2, 2018 in ET Docket No. 18-21, at 2.

[21] Ericsson Comments at 14.

[22] CTIA Comments at 7.

[23] CTIA Comments at 7-8.

[24] Qualcomm Comments at 7-8.

[25] CTIA Comments at 4.

point operations must be on notice that geographic licensing of the spectrum for mobile use may be permitted in the future and their operations may be subject to that use."[26]

Qualcomm proposes to open the "lower" Spectrum Horizons bands for mobile use, including the 95-100 GHz, 102-109.5 GHz, 111.8-114.25 GHz, 122.25-123 GHz, 130-134 GHz, 141-148.5 GHz, and 151.5-158.5 GHz bands.[27] While the Satellite Industry Association ("SIA") primarily asserts permitting mobile use above 95 GHz at this time would be premature, it suggests that if the Commission does open some spectrum for mobile operations, it should be "limited to portions of the 102-109.5 GHz, 111.8-114.25 GHz, 130-134 GHz, or the 151.5-158.5 GHz bands, which are not shared with satellite or other non-FS terrestrial services."[28] There is significant overlap between these lists, and TIA believes there could be a viable path for the Commission to adopt service rules for mobile technologies in some bands above 95 GHz.

D. The Commission Should Consider Making Spectrum Above 275 GHz Available for Fixed Point-to-Point Service.

TIA agrees with Ericsson that the Commission should consider making some spectrum above 275 GHz available for fixed point-to-point service.[29] Spectrum from 275-450 GHz is on the agenda for WRC-19,[30] and a wireless communications standard for spectrum from 252-325

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[26] T-Mobile Comments at 5-6.

[27] Qualcomm Comments at 7.

[28] Comments of the Satellite Industry Association, filed May 2, 2018 in ET Docket No. 18-21, at 7-8 ("SIA Comments").

[29] Ericsson Comments at 18.

[30] WRC-19 Agenda Item 1.15; *see* International Telecommunication Union, *World Radiocommunication Conference 2019 (WRC-19), Agenda and Relevant Resolutions*, at 3 (item 1.15), https://www.itu.int/dms_pub/itu-r/oth/14/02/R14020000010001PDFE.pdf (visited May 16, 2018); *see also* WRC-15 Resolution 767, *Studies towards an identification for use by administrations for land-mobile and fixed services applications operating in the frequency range 275-450 GHz*, https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0016PDFE.pdf (visited May 18, 2018)

GHz has recently been adopted by the IEEE 802 LAN/MAN Standards Committee.[31] These developments demonstrate that there is industry interest in these bands, and opening those bands could potentially create large, continuous swaths of spectrum for future applications.[32]

E. The Commission Should Open 15.2 GHz of Spectrum Above 95 GHz for Unlicensed Use.

TIA supports the widespread consensus in the record in favor of the Commission's proposal to open 15.2 GHz for unlicensed use in the 122-123 GHz, 174.8-182 GHz, 185-190 GHz, and 244-246 GHz bands.[33] TIA further agrees with Qualcomm that the Commission should apply the rules in Section 15.255 governing unlicensed operations in the 57-51 GHz band, while remaining open to modifying those rules if changes "can improve spectral efficiency and service to end users."[34]

F. The Commission Can Consider Reserving Some Spectrum for Preferential Use by Satellite End User Terminals.

TIA does not oppose the request from SIA to reserve a limited amount of spectrum, perhaps seven gigahertz, for preferential use by satellite end user terminals.[35] As SIA points out, satellite broadband coverage is ubiquitous, and allocating dedicated spectrum for ubiquitously deployed end-user terminals facilitates the expansion of a technology that helps to achieve wider

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[31] IEEE 802 LAN/MAN Committee Comments at 1-2.

[32] *See* Ericsson Comments at 19.

[33] Notice ¶¶ 52-63; *see* Qualcomm Comments at 10; CTIA Comments at 12-13; IEEE 802 LAN/MAN Committee Comments at 2; Comments of the Consumer Technology Association, filed May 2, 2018 in ET Docket No. 18-21, at 7-8 ("CTA Comments"); *see also* Comments of Facebook, Inc., filed May 2, 2018 in ET Docket No. 18-21, at 3-4 (urging the Commission to go further); Comments of The Boeing Company, filed May 2, 2018 in ET Docket No. 18-21, at 9-12 (same); Comments of Apple Inc., filed May 2, 2018 in ET Docket No. 18-21, at 4-6 (same).

[34] Qualcomm Comments at 10.

[35] SIA Comments at 10-12.

spread next-generation broadband connectivity; complementing terrestrial fixed point-to-point, point-to-multipoint and mobile operations.[36] While SIA suggests that seven gigahertz could be identified from within the 209-226 GHz band, TIA urges that any such allocation be carefully and thoughtfully selected by the Commission as part of a more comprehensive plan that considers technology developments and maximizes large, contiguous allocations of spectrum to the greatest extent possible.

G. The Commission Should Carefully Consider Global Harmonization, Including Potential European Band Plans for Spectrum Above 95 GHz.

The Commission should carefully consider the band plans for the W-band (92-114.25 GHz) and the D-band (130-174.8 GHz) that are currently under consideration before the Electronic Communications Committee of the European Conference of Postal and Telecommunications Administrations ("CEPT").[37] TIA has long agreed with the principle stated by Ericsson that "harmonized band plans will enable equipment manufacturers to achieve the economies of scale that are essential to making cost-efficient global products."[38] There are potentially several factors at play here, including existing U.S. allocations above 95 GHz and the possible desire to conform band plans or possibly channelization with the rules for spectrum below 95 GHz. Regardless, TIA strongly urges the Commission to carefully consider these

[36] SIA Comments at 11.

[37] *See* European Communications Office, *To facilitate the deployment of fixed services links in the frequency blocks already allocated to fixed services in the frequency range 92 – 115 GHz*, Work Item SE19_37, https://eccwp.cept.org/WI_Detail.aspx?wiid=534, and *To facilitate the deployment of fixed services links in the frequency bands already allocated to fixed services: 130 – 134 GHz; 141 – 148.5 GHz; 151.5 – 164 GHz and 167 – 174.7 GHz*, Work Item SE19_38, https://eccwp.cept.org/WI_Detai-l.aspx?wiid=535.

[38] Ericsson Comments at 11.

issues, including possible direct communication or even coordination with staff at CEPT, as it moves ahead to establish rules in this proceeding.

IV. THE COMMISSION SHOULD MODIFY OR ESTABLISH TECHNICAL AND EQUIPMENT AUTHORIZATION RULES FOR EQUIPMENT OPERATING ABOVE 95 GHZ.

TIA and its members continue to review the Commission's proposed technical rules for equipment operating above 95 GHz, as well as detailed proposals for changes from some commenters.[39] We expect to continue working with the Commission on these issues going forward. For now, the Commission should eliminate or relax the antenna gain requirement, should permit approval of equipment through the Supplier's Declaration of Conformity procedure, and should establish provisional rules for RF exposure in order to permit equipment to actually be approved in the Spectrum Horizons bands. TIA also supports the Commission's planned approach of providing measurement guidance through its knowledge database (KDB) process as products are developed.

A. The Commission Should Eliminate the Antenna Gain Requirement or Relax It to No Higher Than 35 dBi.

There is widespread agreement that the Commission should adopt a lower minimum antenna gain requirement, and definitely not the 50 dBi requirement that applies to the 90 GHz band for the bands above 95 GHz. For example, CTIA supports the Commission's proposal to apply the more relaxed 43 dBi antenna gain limit that is applicable to the 70 & 80 GHz spectrum bands.[40] T-Mobile believes an appropriate minimum antenna gain is 38 dBi.[41]

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[39] *See, e.g.,* T-Mobile Comments at 8-9 (proposing changes to maximum beamwidth, co-polar and cross-polarization discrimination requirements, etc.).

[40] CTIA Comments at 6.

[41] T-Mobile Comments at 8.

TIA, however, supports Ericsson's proposal of eliminating the antenna gain requirement entirely, or alternatively specifying a requirement no higher than 35 dBi.[42] As Ericsson points out, "[m]ast sway can cause an antenna to move out of alignment with the antenna transmitting to it, thereby interrupting the link," and the problem can be solved simply by eliminating the requirement for transmitters above 95 GHz.[43] Alternatively, 35 dBi is the "recommended maximum antenna gain for sites with mast sway, such as small cell backhaul sites mounted on lighting poles."[44]

B. The Commission Should Use the Supplier's Declaration of Conformity Procedure Rather Than Certification.

TIA agrees with Ericsson that the Commission should use the Supplier's Declaration of Conformity ("SDoC") procedure to authorize transmitter equipment, rather than certification.[45] As Ericsson points out, the narrow beamwidths of antennas and more difficult propagation conditions limit the potential for harmful interference, thus increasing suitability for the SDoC procedure rather than certification.[46]

C. The Commission Should Extend its RF Exposure Rules on an Interim Basis Pending Further Action in a Separate Proceeding.

TIA agrees with Qualcomm and the mmWave Coalition that the Commission's existing RF exposure rules should be extended on an interim basis up to 300 GHz – or however high the Commission establishes service rules in this proceeding – so that the development of equipment

[42] Ericsson Comments at 16.

[43] *Id.*

[44] Ericsson Above 100 GHz Report at 8.

[45] Ericsson Comments at 19.

[46] *Id.*

can proceed.[47] As the mmWave Coalition points out, the existing RF exposure limits up to 100 GHz are based on an IEEE standard that extends to 300 GHz.[48] Qualcomm urges the same outcome, noting that should the Commission subsequently decide to relax its RF exposure rules in the broader proceeding, it can provide relief for the Spectrum Horizons bands to the extent that proceeding requires additional time.[49] Similarly, the Consumer Technology Association urges the Commission to provide greater clarity regarding RF exposure rules above 100 GHz, and TIA agrees with CTA that uncertainty "has the strong potential to impede innovation in these bands."[50] More generally, the Commission should prepare to harmonize its limits to the upcoming IEEE C95.1-2018 standard.

D. The Commission Should Implement Measurement Procedures by Means of its Knowledge Database and Ensure that the Agency is Well-Staffed to Implement Those Procedures.

TIA agrees with the mmWave Coalition that the Commission should adopt its proposal to provide guidance on measurement procedures by means of knowledge database ("KDB") publications as products are developed, seeking notice and comment as appropriate.[51] This approach is particularly appropriate given the nascent state of new technologies in these bands. Meanwhile, TIA and its members have not yet had opportunity to fully review the detailed

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[47] Qualcomm Comments at 11-12; mmWave Coalition Comments at 10.

[48] mmWave Coalition Comments at 11 (citing American National Standards Institute (ANSI), *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*, ANSI/IEEE Std C95.1-1992, Sections 4.1 and 4.2; and European Union, *Council Recommendation on the Limitation of Exposure of the General Public to Electromagnetic Fields (0 Hz to 300 GHz)*, 1999/519/EC, July 12, 1999, *available at* https://ec.europa.eu/health/sites/health/files/electromagnetic_fields/docs/emf_rec519_en.pdf).

[49] Qualcomm Comments at 11.

[50] CTA Comments at 9.

[51] Notice ¶ 83; mmWave Coalition Comments at 13-14.

comments on measurement procedures proposed by Underwriters Laboratories,[52] and expect that such comments would be considered by the Office of Engineering and Technology ("OET") when developing KDB guidance.

That said, the Commission should ensure that the process of issuing KDB guidance does not become a mechanism for delay in approving Spectrum Horizons equipment. With many new technologies coming in the next few years, TIA shares CTA's opinion that the Commission must ensure the agency has a sufficient number of qualified engineers to facilitate new solutions, identify new bands of spectrum for commercial use, and increase the efficiency of sharing capabilities.[53] Like CTA, TIA applauds the recent creation of an Honors Engineer program and is willing to work with the Commission to help ensure that program becomes successful over time.[54]

[52] *See* Underwriters Laboratories Comments.

[53] CTA Comments at 8-9.

[54] FCC News Release, *FCC Launches New Honors Engineering Program*, Apr. 2, 2018; CTA Comments at 9.

V. CONCLUSION

TIA appreciates the Commission's work to propose service rules that would make spectrum available above 95 GHz for next-generation technologies. We look forward to continued work with the Commission on these issues in the months and years to come.

Respectfully submitted,

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May 17, 2018